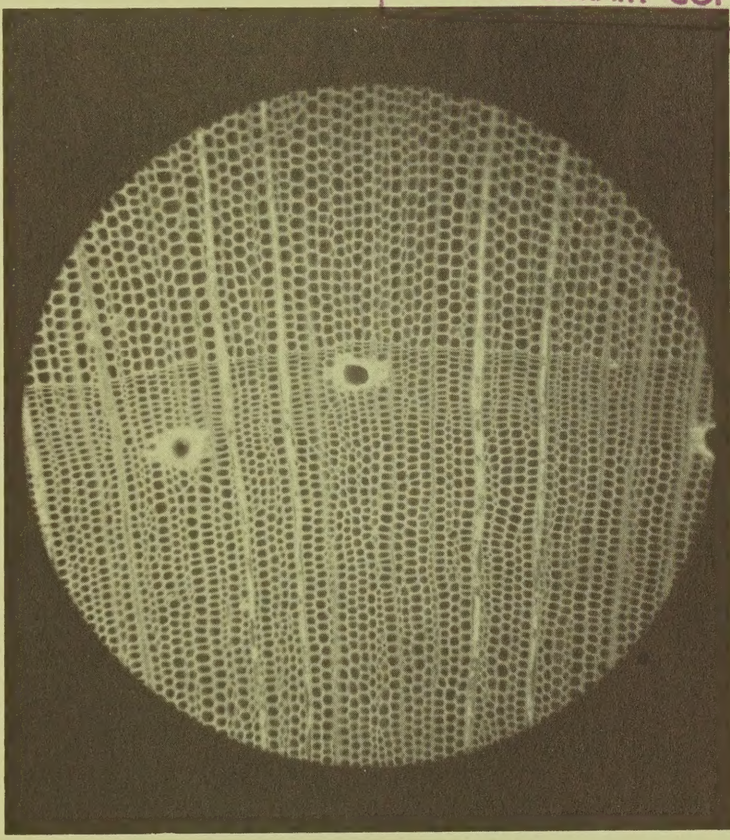
FROM WOOD RESEARCH

Annual Reports

**RECENT PUBLICATIONS
OF THE
FOREST PRODUCTS LABORATORY
FOREST SERVICE
USDA
1974**



Many dividends come from wood research, but the most lasting one is research information put into practice. The first step in that sometimes lengthy path is publication of the research findings.

Here are some recent publications of the Forest Products Laboratory. Those of general interest to a broad audience are listed first. Others that are highly technical and of interest mainly to other research scientists are listed toward the rear.

If you are interested in some of these publications, please request them on the back cover of this booklet. You may be the vital link in getting the dividends of wood research into use.

H.O. Fleischer
Director, FPL

WOOD . . .

EVER-NEW ANSWER TO TODAY'S
MATERIALS PROBLEMS:

Renewable resource

Requires low energy to process

Low pollution rate

Familiar material to handlers and users

Strong and beautiful

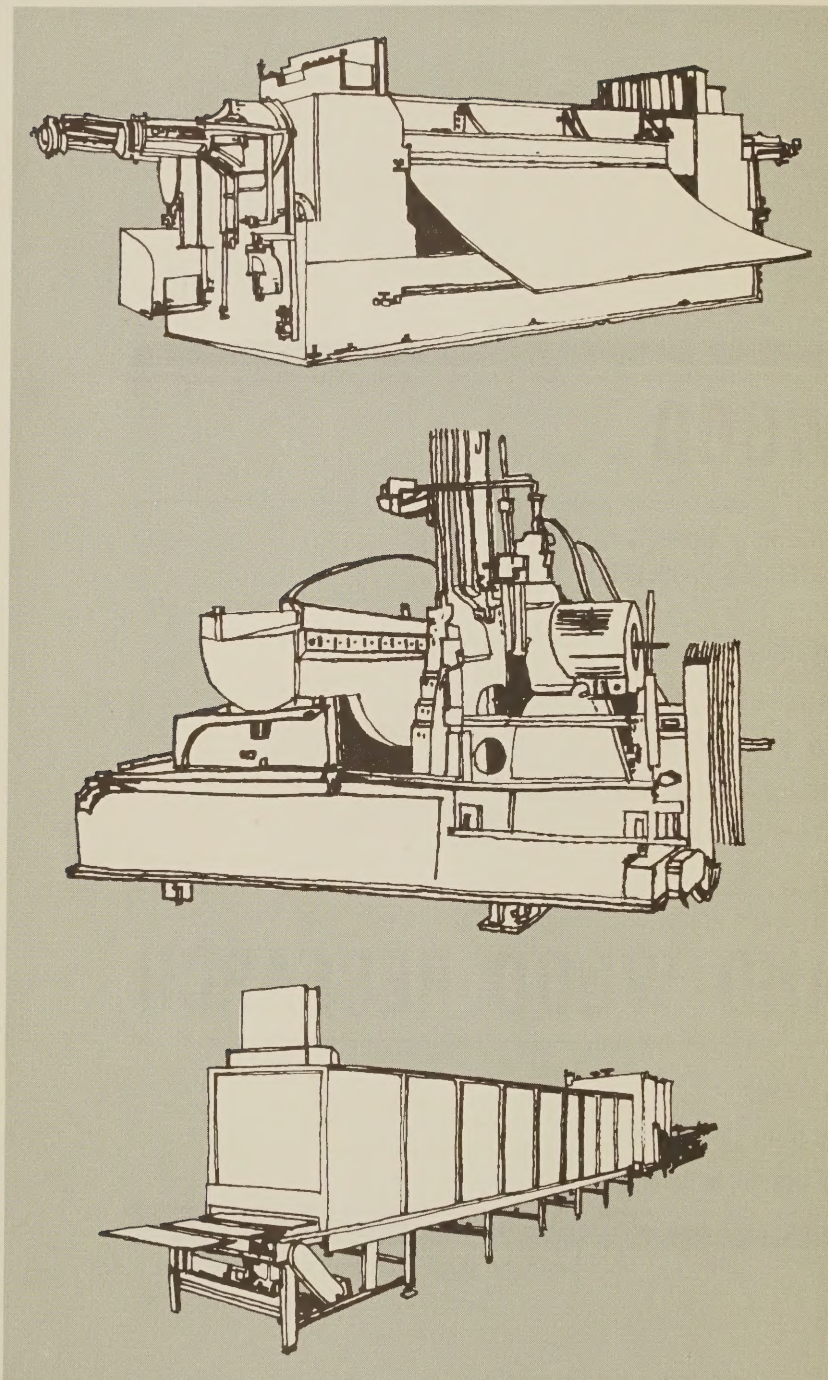
AND WOOD RESEARCH

is the Key

To More Efficient Use

Of this Versatile Material

Here are some examples of FPL results



1

TECHNIQUES FOR PEELING, SLICING, AND DRYING VENEER

BY JOHN F. LUTZ
USDA FOREST SERVICE
RESEARCH PAPER FPL 228

Practically any wood species that grows in the United States can be cut into veneer—but how it is done varies widely. Some species are easier to work than others, experience and equipment of individual operators runs the gamut, and users want different products for a variety of uses.

This report attempts to summarize the general techniques in processing logs into dry veneer. Because of the differences in species, products, and operations in general, many experienced operators hold views that are contradictory. Here many of these varying points of view are considered and the principles recognized.

In addition to current commercial practice, recent research is summarized that may find application in the industrial production of veneer.

These generalizations have particular importance in the search for new veneer species, both domestic and foreign. And the final judgment is how the logs cut and the veneer dries.

2

INCREASING SERVICEABILITY OF WOOD PALLETS

BY ROBERT K. STERN
USDA FOREST SERVICE
RESEARCH PAPER
FPL 215

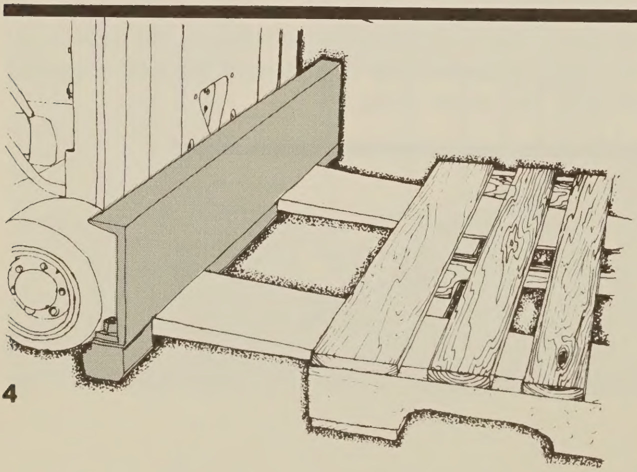
More than 12 percent of the annual cut of timber in the United States is used for pallets to transport, handle, and store quantities of goods.

Many of these pallets are destroyed by the rough handling they receive, often from the forklift truck that lifts and moves them. Most damage comes when the tines of the forklift strike the edge of the leading deckboard on the pallet.

This study indicates that pallet life could be greatly extended by adding an impact panel to the forks of the forklift. Such an impact panel would equalize stresses on the pallet stringers.

In laboratory tests with such a panel, nailed pallets survived more than 60 times as many impacts as with a conventional forklift.

Obviously, longer life for pallets would mean less drain on the timber resource, and result in fewer damaged pallets that must be recycled.



3

TAPER OF WOOD POLES

BY BILLY BOHANNAN, HERMANN HABERMANN
AND JOAN E. LENGEL
USDA FOREST SERVICE
GENERAL TECHNICAL REPORT FPL-2

The ordinary round wood pole may be far from simple for a designer—especially if the pole must be very long.

Engineers have been designing with poles on the basis that maximum stress generally occurs at the groundline. But usage of poles has changed, and now poles are frequently longer and larger. With these long poles the theoretical maximum stress is usually located some distance above the groundline. How much above depends on the shape or taper of the pole. This work determined the taper of typical poles.

Data on three species of poles indicated that taper can be predicted from the minimum diameters of tip and butt of the pole. A straight line between those dimensions gives a value that is conservative for design.

4

PROPERTIES OF STRUCTURAL PARTICLEBOARDS

BY W.F. LEHMANN
FOREST PRODUCTS JOURNAL
24 (1): 19-26, 1974

While particleboard has been produced in the United States for a quarter of a century, it is just being recognized as a structural building material. But what raw material variables would give the best and most economical particleboards for structures?

In this study a homogeneous panel provided optimum durability, strength, and stability. This combined large thin flakes of Douglas-fir with about 5 percent phenol-formaldehyde resin and 1 percent wax. The resulting panel weighed about 37.5 to 42.5 pounds per cubic foot.

Panels with increased bending strength and stiffness in one panel direction can come from orienting the flakes within the panel, or by applying veneer overlays at the time of pressing. However, this sacrifices strength in the alternate direction.

Properties equivalent to the homogeneous boards can be achieved in panels by using high-quality flakes only on the surfaces, with lower quality material in the core.

5

BARK PROPERTIES OF EIGHT WESTERN SOFTWOODS

BY DANIEL L. CASSENS
FOREST PRODUCTS
JOURNAL 24(4): 40-45. 1974

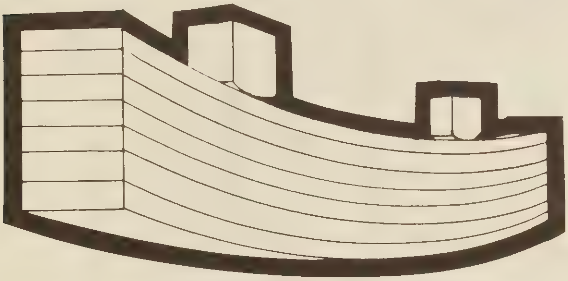
Bark comprises roughly a tenth of the wood harvested, and is a major problem for all primary processors of logs. A better understanding of its basic physical and mechanical properties could result in additional uses for bark.

This paper describes the properties of bark of eight western softwoods. Included are specific gravity, swelling properties, and shear strength. Results from fresh specimens of standing trees are compared with those from specimens accumulated at mill sites.

Specific gravity of the outer bark of ponderosa, sugar, and Jeffrey pine and incense-cedar ranged between 0.27 and 0.36. For redwood, Douglas-fir, and red and white fir, specific gravity was between 0.43 and 0.60. Specific gravity of the cell wall corresponds closely to that for wood.

In this era of shortages, bark may become an important ingredient in new products, but only if we have the basic information to build upon.

OTHER DIVIDENDS FROM WOOD RESEARCH



BEAM STRENGTH

6. Time-Dependent Characteristics of Prestressed Beams, by Billy Bohannan. USDA Forest Serv. Res. Paper FPL 226. 1974.

Earlier research suggested that prestressing wood beams could increase their flexural strength and decrease the variability in any low-quality beams. However these results were from short-time tests. What about long-term use in structures?

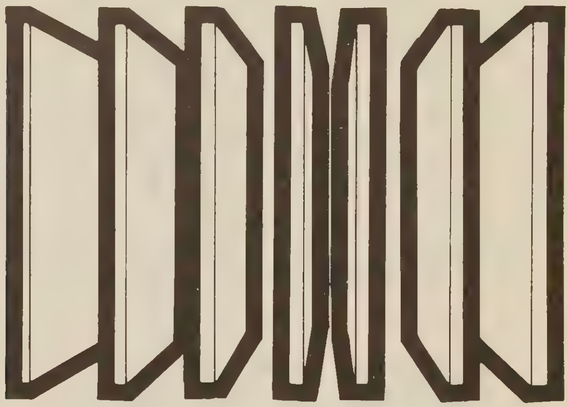
To evaluate the change in prestressing force due to time-strain characteristics of the wood, matched pairs of prestressed beams and non-prestressed control beams were loaded for 8 years. Stress levels were 1,600 and 2,500 pounds per square inch.

The time-deflection performance of the matched pairs was consistently similar, and there was no significant loss in the prestressing force. These data indicate that prestressed beams should give adequate performance in structures.

7. Flexural Strength of Glued-Laminated Timber Beams Containing Coarse-Grain Southern Pine Lumber, by R.C. Moody. USDA Forest Serv. Res. Paper FPL 222. 1974.

Coarse-grain southern pine, defined as having fewer than four rings per inch, has been excluded from material used in laminated timbers. But laminators of southern pine report difficulty in purchasing timber that does not contain coarse grain.

To evaluate strength factors for coarse-grain southern pine, 20 large glued-laminated beams with coarse-grain inner laminations were tested to failure. Compared to existing combinations, beams containing coarse-grain lumber seem likely to have lower bending strength, stiffness, and shear strength.



BOARD PRODUCTS

8. Hardboard: A Potential Outlet for Waxed Container Waste, by Paul E. Steinmetz. Tappi 57(2):74-77. Feb. 1974.

Waste from waxed corrugated board was used successfully to manufacture wet-formed hardboard. Up to 50 percent of the corrugated pulp was added to typical aspen furnishes without affecting the drainage characteristics of the stock.

Fiberizing the corrugated material separately from the aspen provided a stronger board, but fiberizing the components together imparted greater dimensional stability.

Boards containing wax-dipped corrugated and 1 percent phenol-formaldehyde resin exceeded strength and stability requirements.

9. Producing Hardboards from Red Oak, by P.E. Steinmetz. USDA Forest Serv. Res. Paper FPL 219. 1973.

Despite oak's place among the predominant U.S. hardwood species, it has not been used extensively for hardboard. But increasing production of hardboard has forced new attempts to improve strength and stability of oak hardboard.

To improve both wet-formed and dry-formed hardboards from oak, four approaches were investigated—extractives removed, pulp yield reduced, fiber pH adjusted, and resin content increased. All properties were improved by increased resin content. Dry-formed boards were also greatly improved by adjusting the pH of the fibers before resin treatment.

10. Effects of Equilibrium Moisture Content Changes on Hardboard Properties, by J. Dobbin McNatt. Forest Prod. J. 24(2):29-35. Feb. 1974.

Hardboard, like other wood-base materials, is deeply affected by moisture content changes. Understanding these effects on strength and elastic properties is essential for proper structural use of hardboard, especially for exterior applications.

Strength and elastic properties of six commercial tempered hardboards at humidities between ovendry and 50 percent ranged from 100 to 120 percent of control values at 65 percent relative humidity (RH). Values ranged from 80 to 98 percent of controls at 80 percent RH, and from 75 to 90 percent of controls at 90 percent RH. These results will serve as basic information in investigations of the effects of cyclic moisture changes in structural applications.

11. Visual Method for Measuring Formaldehyde Release from Resin-Bonded Boards, by John M. Harkin, John R. Obst, and William F. Lehmann. Forest Prod. J. 24(1):27-30. Jan. 1974.

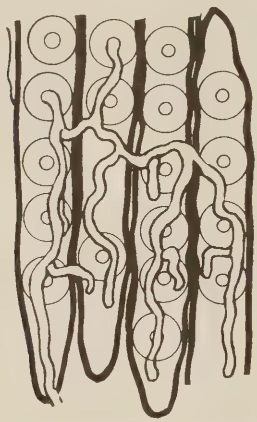
One drawback to greater use of particleboard and fiberboard in building construction and furniture is that some boards release small amounts of formaldehyde. But which ones, and how to detect them? This report describes one simple test.

An alkaline solution of purpald absorbs formaldehyde vapor quantitatively from air and turns purple. Under standard conditions, the intensity of the color can be used to measure release of formaldehyde from particleboard or fiberboard bonded with urea-formaldehyde or phenol-formaldehyde resins. An airflow test and a spot test using purpald can be used for grading boards or for determining satisfactory curing. Because of their simplicity and rapidity, these tests could be used routinely or in spot checks in board manufacturing plants.

12. Elastic Bearing Constants for Sheathing Materials, by Thomas Lee Wilkinson. USDA Forest Serv. Res. Paper FPL 224. 1974.

Rigidity and strength of wood structures depend greatly on the joints—both the materials being fastened and the fastener. To predict the lateral resistance of nailed joints, theoretical methods of analysis have been developed by incorporating a material property called the elastic bearing constant.

This report extends that information, with specific values of elastic bearing constant being determined for plywood, hardboard, insulating board, particleboard, and gypsum board. Results also support previous results and suggest their application to broader usage.



DEGRADATION

13. Lignin Biodegradation and the Bioconversion of Wood. by T. Kent Kirk and John M. Harkin. AlChe Symposium Series 69(133):124-126. 1973.

Protecting wood from decay is a common responsibility in wood research, but what about the beneficial effects of micro-organisms in degrading wood? Past research has indicated that organisms might convert wood to desirable products, but a main problem is their inability to break down the lignin portion of the wood.

This report summarizes some of the information on lignin and how it is decomposed by various organisms. It also points out some of the questions that must be answered about bio-conversion of wood.

14. Quantitative Changes in Structural Components of Conifer Woods During Decay by White- and Brown-Rot Fungi. by T.K. Kirk and T.L. Highley. Phytopathology 63(11):1338-1342. Nov. 1973.

The rates at which fungi degrade the structural elements of softwood were recorded for the first time. Results provide an estimate of how common test fungi broke down the lignin, cellulose, and hemicellulose in five conifer woods.

Three white-rot fungi removed all major wood components progressively during decay. By contrast, three brown-rot fungi removed the polysaccharides (representing cellulose) but not the lignin. The brown-rot fungi had similar progressive effects on the chemical composition of all woods. But in the white-rot decay, the relative rates of removal of components varied, more so with a given fungus on different woods than with different organisms on the same wood.

15. Polysaccharide Integrity as Related to the Degradation of Lignin in Wood by White-Rot Fungi, by T. Kent Kirk. Phytopathology 63(12):1504-1507. Dec. 1973.

Research has shown that much of the lignin in wood can be degraded by certain white-rot fungi without a proportional depletion of carbohydrates.

Data presented here suggest that lignin in wood may be degraded by these white rotters without proportional degradation of the polysaccharides as well. It follows that the polysaccharides in wood probably do not present enough barrier to the degradation of lignin by white-rot fungi.

16. Methane Formation in Living Trees: A Microbial Origin, by J.G. Zeikus and J.C. Ward. Science 184(4142):1181-1183. 14 June 1974.

Flammable gases trapped in living trees have been reported to contain methane. This research confirmed the presence of methane in the trunk gases of certain hardwood trees, and showed that it was formed by bacteria.

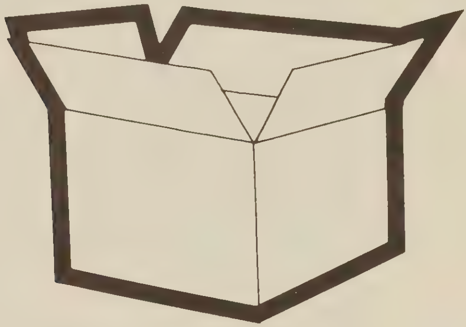
Methane, under pressure and often capable of being ignited, was detected in cottonwood, elm, and willow trees that contained wetwood, an abnormal type of heartwood. The organism that produced this gas was generally identified as a member of the genus Methanobacterium.

17. Influence of Carbon Source on Cellulase Activity of White-Rot and Brown-Rot Fungi, by Terry L. Highley. Wood and Fiber 5(1):50-58. 1974.

In trying to protect wood from decay, one avenue might be through the cellulases that fungi produce—cellulases that in turn degrade the cellulose in wood. Could the synthesis of cellulases be regulated through the source of carbon?

In this study differences were observed in the inducing and repressing of cellulases and in the type of cellulases formed by the fungi. The repression by simple sugars of cellulase formation by white-rot fungi raises the possibility of using non-metabolizable sugar analogs to control this type of decay.

This work failed to disclose new clues as to why white-rot fungi prefer hardwoods and brown-rot fungi prefer softwoods.

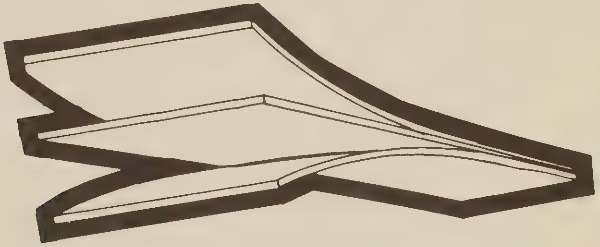


PACKAGING

18. Pallet Research at the U.S. Forest Products Laboratory, by Robert S. Kurtenacker. Southern Lumberman 227(2824):110-11. Dec. 15, 1973.

Growth of the pallet industry has been astronomical, doubling in the last decade. This industry effectively utilizes low-grade lumber for a product vital to the industrial well-being of the United States.

Since 1943, the U.S. Forest Products Laboratory has worked with pallets—for better design, extended performance life, and increased use of forest material. This article summarizes this research—the objectives of which continue to be the best use of timber and increased benefits to the Nation.



PLYWOOD AND VENEER

19. If We Need It—Construction Plywood from Hardwoods is Feasible, by John Lutz and R.W. Jokerst. Plywood & Panel 14(9):18-20. Feb. 1974.

One way to supplement the supply of softwood construction plywood would be to use hardwoods. While there are technical limita-

tions, these do not appear insurmountable. A combination of dense, strong hardwoods such as oak for face plies and low-density hardwoods like aspen and cottonwood for inner plies appears promising.

20. Drying Veneer to a Controlled Final Moisture Content by Hot Pressing and Steaming, by John F. Lutz. USDA Forest Serv. Res. Paper FPL 227. 1974.

A problem with currently used continuous mechanical veneer dryers is their inability to control the final moisture content of the veneer within the limits desirable for further processing.

This report describes successful control of the final moisture content of veneer by steaming during press drying. Final moisture contents of 4, 5-1/2, 7, and 11 percent, ± 1 percent, were obtained by control of the steaming temperature. The ability to control the moisture content of veneer out of a dryer can result in less degrade, less loss by shrinkage, and provide veneer more suitable for gluing.

21. Press-Drying Green, Flatsliced Walnut Veneer to Reduce Buckling and End Waviness, by John F. Lutz, Hermann Habermann, and Harry R. Panzer. Forest Prod. J. 24(5):29-34. May 1974.

Objectionable buckle occurs in 30 to 50 percent of decorative face veneer during the drying process. One cause of buckle is nonuniform drying—such as the end waviness that occurs when the ends of a veneer sheet dry faster than the center. Exploratory work indicated that press drying might help this and other causes of buckle.

Not only was press drying about 30% faster than a roller-conveyor dryer, but buckle was reduced to about one-third.

Most effective drying condition tried was to press-dry flatsliced walnut veneer 0.030 inch thick at 230°F and a pressure of 50 psi to a moisture content of 5 to 7 percent.

PROTECTION

22. Evaluating Chemicals for Controlling Biodeterioration of Stored Wood Chips, by W.E. Eslyn. Forest Prod. J. 23(11):21-25. Nov. 1973.

Stain and decay fungi take their toll in wood stored as chips by the pulp and paper industry. Chemical controls are needed, but which chemicals would be effective, not contribute to air or stream pollution, and be tolerated in pulping?

Of the 30 chemicals evaluated in this long-range study, 23 proved effective at various concentrations. Before any can be recommended for chip piles, they must undergo further field test.

23. An Apparatus Developed to Measure Rate of Heat Release from Building Materials, by J.J. Brenden. USDA Forest Serv. Res. Paper FPL 217. 1973.

Code officials in defining "combustibility" of building materials have considered measuring this property in relation to the total heat content of the material. A better method of defining combustibility could be to measure the "rate of heat release," the time-rate at which the heat of combustion is released.

This paper describes equipment to measure rate of heat release of wood and wood-base products and assemblies. Based on the input and output data for this system, the rate of heat release from the test specimen can be computed.

24. **Comparison of Wood Preservatives in Mississippi Post Study (1973 Progress Report), by L.R. Gjovik and H.L. Davidson. USDA Forest Serv. Res. Note FPL-01. 1973.**

To compare service results of various wood preservatives, both treated and untreated experimental fence posts in Mississippi have been examined since 1936.

The posts were treated with a total of 24 types of preservatives. Many of these preservatives are providing average service lives of more than 30 years—compared to the average of less than 4 years for untreated posts.

25. **Comparison of Wood Preservatives in Stake Tests (1973 Progress Report), by L.R. Gjovik and H.L. Davidson. USDA Forest Serv. Res. Note FPL-02. 1973.**

Test stakes, untreated and treated by pressure and nonpressure processes, have been evaluated at six sites since 1938. Sites are in Mississippi, Wisconsin, Louisiana, Florida, and Panama to give a variety of conditions.

While the untreated southern pine stakes averaged from 1 to 6 years at various locations, superficial treatments by dipping or brushing added from a few months to 4 years to stake life. Best protection has consistently come from the more complete treatments.

26. **The Characterization of Wood-Preserving Creosote by Physical and Chemical Methods of Analysis, by F.H. Max Nestler. USDA Forest Serv. Res. Paper FPL 195. 1974.**

Published data show that between 11 and 22 of the many hundreds of compounds stated to be present in whole creosote can be designated as major components.

Importantly, no known analytical method can simply analyze whole creosote oil or its mixture with coal-tar creosote in terms of pure compounds. While broad generalizations have been reported, there is need for more detailed knowledge of chemical composition.

Data here are correlated with the various analytical methods used. Two categories of information include lists of specific compounds identified as present, and fractions of creosote, any one of which may contain similar fractions.

27. Characterization of Wood-Preserving Coal-Tar Creosote by Gas-Liquid Chromatography, by F.H. Max Nestler. Analyt. Chem. 46(1):46-53. 1974.

Specific and general methods of analyzing the components of coal-tar creosote, widely used in the preservation of poles, ties, and other large wood members, are inadequate. Could gas-liquid chromatography be used?

Six whole coal-tar creosotes, two of which represent current commercial production, were analyzed by gas-liquid chromatography. Results were correlated with valid generalizations provided by the older methods of analysis. This interpretation of isothermal chromatograms in terms of simulated distillation and analysis agreed very well with precision fractional distillation data, but less so with the American Wood-Preservers' Association Standard Method.

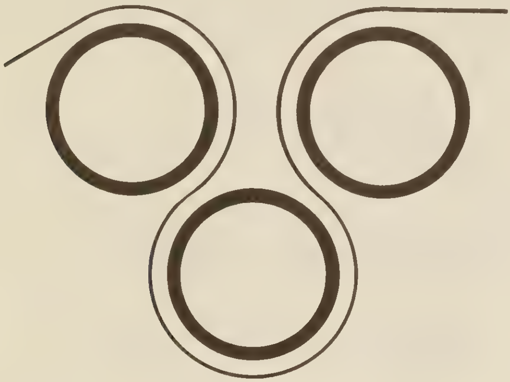
This material could be used in establishing specifications for the production of creosote, which would be helpful to manufacturers as well as users.

28. Attractant-Mirex Bait Suppresses Activity of *Reticulitermes* spp. by G.R. Esenther and R.H. Beal. J. of Econ. Entomology 67(1):85-88. Feb. 1974.

Small decayed wood bait blocks, impregnated with an insecticide and installed below ground, previously suppressed subterranean termites in Ontario.

But would the bait be effective in a warm climate, where termites are abundant and very destructive?

Results in Mississippi, reported here, were promising. In one trial, wood bait blocks pressure-treated with mirex and buried at 5-foot spacings suppressed termites for 3 years. This implies that these baits may be able to protect wood buildings from termite attack.



PULP AND PAPER

29. How Much Moisture Is Needed to Develop Strength in Dry-formed Handsheets? by Von L. Byrd. Tappi 57(4):131-133. Apr. 1974.

Dry-forming has great promise to reduce pollution from conventional methods of paper formation. But even dry formation apparently requires some moisture to take advantage of hydrogen bonding. So how much moisture?

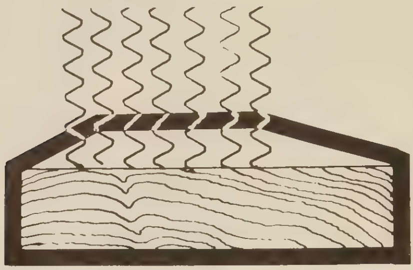
In dry-formed handsheets, strength and interfiber bonding properties generally increased with moisture content level before pressing. However, strength was reduced if moisture content after pressing was higher than about 20%.

The dry-formed sheets, when soaked and then pressed to 23% moisture content, had tensile properties comparable to conventional wetformed sheets and to linerboard in the crossmachine direction.

30. Carbohydrate Stabilization with Iodide in Oxygen Bleaching of Kraft Pulps, by James L. Minor and N. Sanyer. Tappi 57(2):109-112. Feb. 1974.

Oxygen bleaching offers promise in reducing the volume and polluting nature of bleach plant effluents. A major difficulty in its implementation, however, is in the depolymerization of the polysaccharides of papermaking fibers.

Here the viscosity of southern pine kraft pulps was substantially increased by adding iodide to alkaline bleaching liquors. The simultaneous addition of both iodide and magnesium gave complementary and additive results. Improved strength properties reflected increased polysaccharide stabilization.



WOOD DRYING

31. Kiln Drying of Selected Colombian Woods, by J.M. McMillen and R.S. Boone. Forest Prod. J. 24(4):31-36. Apr. 1974.

Because little information is published on kiln drying tropical woods, what is the best procedure with unfamiliar wood in the kiln? This work developed satisfactory schedules for three Colombian woods through a screening test and a series of refinements. Thus schedules were developed for cuangare, sande, and sajo, either dried separately or together.

Significantly, this procedure may be useful for developing kiln schedules for other unfamiliar woods with similar characteristics.

32. Predicting Equilibrium Moisture Content of Wood by Mathematical Models, by William T. Simpson. Wood and Fiber 5(1):41-49. 1973.

Minimizing problems associated with shrinkage and swelling of wood is vitally important in most phases of processing and end use of wood products. One key is better understanding of the relationship of temperature and relative humidity to equilibrium moisture content (EMC) of wood.

Numerous sorption theories analytically relate EMC to relative humidity. This report evaluates how well these theories functionally link EMC to relative humidity and temperature. The work thus provides improved methods for predicting EMC of wood at many temperatures and relative humidities.

33. Relation of Comparative Diffusion Rates of Oak Ray and Surrounding Tissue to Check Formation, by William T. Simpson. Wood and Fiber 5(1):34-40. 1973.

In kiln-drying hardwoods, surface checking continues to be a significant factor in drying costs. But why the checks?

Here the rate of radial moisture diffusion in desorption was determined for both the ray tissue and surrounding tissue of three species of oak—white, northern red, and cherrybark. In all three, radial moisture diffused faster in the ray tissue than in the surrounding tissue. Apparently this mechanism, previously unexplored, is involved in check formation in kiln-drying hardwoods.

WOOD QUALITY EVALUATION

34. Scanning Electron Microscopy of Bacterial Wetwood and Normal Heartwood in Poplar Trees, by I.B. Sachs, J.C. Ward, and R.E. Kinney. Proc. of the Workshop on Scanning Electron Microscopy and the Plant Sciences, pp. 453-460. Apr. 1974.

Wetwood, an abnormal type of heartwood commonly encountered in trees of Populus species, is extremely slow to dry. But before this condition can be combated, we must know more about it.

Scanning electron microscopy and microbial studies indicate that wetwood is formed in the living tree from bacterial infections. Infected trunk and root tissue contained mixed bacterial populations that always contained the obligate anaerobe Clostridium and usually a microaerophilic bacterium that erodes vessel-ray pit membranes.

35. Bordered Pit Margo: Improved Method for Specimen Preparation, by I.B. Sachs and R.E. Kinney. Wood Science 6(3):200-205. Jan. 1974.

Before the minute structure of wood plant tissues can be studied with the electron microscope, specimens must be precisely prepared. Even the best available techniques, however, may not have been good enough.

With an improved method of tissue dehydration, the details of the ultrastructure of never-dried bordered pit-pair membranes were excellently preserved. Membranes were also of greater density than previously observed.

36. Mechanical, Physical, and Machining Properties of Black Walnut from Indiana and Missouri, by David R. Schumann. Wood and Fiber 5(1):14-20. Spring 1973.

Black walnut is a preferred wood for many purposes, largely because of its appearance, machining characteristics, and strength. This work reported investigations of the relationships of anatomical characteristics and physical features of walnut to its machining and mechanical properties.

Machining properties of black walnut were satisfactory regardless of locality, site, growth rate, and anatomical characteristics. Specific gravity proved to be the one most important characteristic in evaluating machining and mechanical properties.

37. Beat the High Cost of Walnut Turning Blocks, by Harold L. Mitchell, School Shop 33(5):40-41. Jan. 1974.

Walnut is still available for the woodshop at reasonable cost—by getting log cross sections and treating them with polyethylene glycol 1000 (PEG).

This reprint summarizes the monetary and material savings found in round turning blocks. It also gives some tips on where to obtain walnut or other wood residue for home hobby use, and how to use the material most efficiently.

HIGHLY TECHNICAL

CHEMICAL

38. Quantitative Spectrometric Determination Specific for Mannose, by Ralph W. Scott and Jesse Green. Analytical Chemistry 46(4):594-597. Apr. 1974.

Quantitative measurement does not require the separation of mannose from other wood sugars. Wood material can be dissolved in 72 percent H_2SO_4 and its mannose content measured in an hour by spectrophotometry.

39. Effect of Varying Crystallinity of Cellulose on Enzymic Hydrolysis, by Daniel F. Caulfield and Wayne E. Moore. Wood Science 6(4):375-379. Apr. 1974.

X-ray measurements of degree of crystallinity of ball-milled cellulose before and after partial hydrolysis indicate that the mechanical action increases the susceptibility of both the amorphous component and the crystalline component of cellulose. The enzymic digestibility of the crystaline component is enhanced to a greater extent than the amorphous.

40. Linear Liquid Density Gradient Columns: A Simple Reliable Method of Preparation, by John M. Harkin and John R. Obst. Chem. & Ind. 317-318. Apr. 6, 1974.

Liquid linear density gradient columns provide a convenient tool for rapid and accurate density measurement of pure substances or density distributions of mixtures. An adaptation of the "slip-under" method of column preparation has been evolved that requires only simple, readily available equipment which reproducibly affords stable linear gradients.

41. Reversible Deuteration of 2,6-Dimethoxy-1, 4-Benzoquinone in Alkali, by J.R. Obst and J.M. Harkin. J. Org. Chem. 38(18): 3226-3227. 1973.

Quinones undergo rapid decomposition and polymerization in alkali to yield dark humus-like pigments. Base catalyzes rapid reolacement by deuterium of the ring protons in 2,6-dimethoxy-1, 4-benzoquinone in D_2O, establishing that nucleophilic addition of a hydroxyl ion to form an o-quinal structure is the primary step in alkaline decomposition of the quinone.

BIOLOGICAL

42. Cell Wall Formation in Secondary Xylem of *Pinus Strobus* L., by Lidija Murmanis and Irving B. Sachs. Wood Science and Technology 7(3):173-188. 1973.

Vesicular membrane-bound bodies that participate in forming the wall of differentiating xylem cells appear on electron microscopical examination to originate from the Golgi apparatus. Golgi bodies release vesicles which are seen at different stages on their path to the cell wall; their contents come in contact with the wall by fusion of vesicular membranes with the plasmalemma.

43. Some Notes on *Pseudotomentella*, by M.J. Larsen. Mycologia 66(1): 165-168. Jan.-Feb. 1974.

Reports an undescribed species of *Pseudotomentella* from western North America, occurrence of chlamydospores in *P. vepallidospora*, and provides a revised key to known species of *Pseudotomentella.* Descriptive data are based on tissues mounted in 10% aqueous KOH, stained with aqueous solution of phloxine B.

44. New Taxa of *Laeticorticium* (Aphyllophorales, Corticiaceae), by M.J. Larsen and R.L. Gilbertson. Can. J. Bot. 52:687-690. 1974.

Three species of *Laeticorticium* are described as new: *L. canfieldii* from Arizona; *L. durangensis* from Mexico; and *L. mississippiensis* from Mississippi.

45. pH-Related Color Changes in Certain Species of *Lazulinospora, Pseudotomentella,* and *Tomentella* by H.H. Burdsall, Jr. and E.C. Setliff. Mycologia 66(1):101-106. Jan.-Feb. 1974.

The hymenia in basidiocarps of several species of *Pseudotomentella, Lazulinospora,* and *Tomentella* are conspicuous because of a change in wall pigment or diffusate to blue or green when mounted in dilute aqueous KOH. The color change, in buffer solutions ranging from pH 2.6 to 12.6 was related to pH rather than being specific for KOH. The color was most intense at about pH 10.0, virtually absent below pH 8.0. The color change was reversible.

46. *Lazulinospora,* a New Genus of Corticiaceae, and a Note on *Tomentella Atrocyanea,* by H.H. Burdsall, Jr. and M.J. Larsen. Mycologia 66(1): 96-100. Jan.-Feb. 1974.

A new genus of the Corticiaceae, *Lazulinospora,* is proposed to accommodate *L. cyanea* and *L. wakefieldii* which possesses septate, hyaline to pale yellow hyphae without clamps and ornamented spores that become blue in KOH. *Tomentella atrocyanea,* whose spores also become blue in alkali solution, possess characters which are like *Pseudotomentella,* but not with *Lazulinospora.* The new combination, *Pseudotomentella atrocyanea* is proposed.

47. Oxgenation of 4-Alkoxyl Groups in Alkoxybenzoic Acids by *Polyporus Dichrous,* by T. Kent Kirk and Linda Lorenz. Applied Microbiology 27(2): 360-367. Feb. 1974.

Studies of the oxidative changes caused by fungi in simple alkoxybenzoic acids provide clues as to how the much more complex lignin polymer is oxidized.

ENGINEERING

48. Design Parameters for Torsion of Sandwich Strips Having Trapezoidal, Rectangular, and Triangular Cross Sections, by H.M. Montrey and Edward W. Kuenzi. USDA Forest Serv. Res. Paper FPL 156. 1973.

Solutions for the elastic torsion of isotropic sandwich strips having triangular, rectangular, or trapezoidal cross sections are presented in a series of design curves for torsional stiffness and maximum facing and core shear stresses.

49. Bending of a Circular Sandwich Plate by Load Applied Through an Insert, by H.M. Montrey. USDA Forest Serv. Res. Paper FPL 201. 1973.

An analytical solution is presented for the elastic bending of isotropic circular sandwich plate having clamped or simply supported edges and being loaded through a circular insert. Explicit expressions for plate bending and shear deflections, core shear stress, and facing radial and circumferential bending stresses are derived and presented as design curves.

50. Local Buckling of Orthotropic Truss-Core Sandwich, by J.J. Zahn. USDA Forest Serv. Res. Paper FPL 220. 1973.

Analyzes the local buckling mode of compression failure of truss-core sandwich when compressed parallel to core flutes. A mathematical analysis is presented for the general case of similar equal orthotropic facings and dissimilar core of unequal sheet thickness. Seven cases are calculated and buckling curves are presented. The results are found to be applicable to dissimilar facings.

51. Compressive and Shear Properties of Polyamide Honeycomb Cores, by Edward W. Kuenzi and Paul M. Jenkinson. USDA Forest Serv. Res. Note FPL-0202. Rev. 1974.

Polyamide honeycomb cores of three densities were evaluated in compression and shear. Compression data included properties at 75°, and 500° F. Effects of high humidity and water soaking on compressive properties were also measured. Properties determined will enable engineers to arrive at rational designs of sandwich constructions using these cores.

52. Mechanical Properties of Diffusion-Bonded Titanium Sandwich Constructions, by Edward W. Kuenzi. USDA Forest Serv. Res. Paper FPL 218. 1973.

The performance of diffusion-bonded titanium sandwich constructions was determined by evaluating flatwise shear, flatwise tensile, and compressive properties at room temperature. Edgewise compression tests were conducted at temperatures up to to 1200°F. Fatigue loading was done in shear, tension, and edgewise compression at room temperature. Effects of increasing temperature dropped static edgewise compressive strength, especially at 1200°F.

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